I claim:

1. Apparatus for making fused silica products, comprising a chamber, at least one substrate positioned in the chamber, and a mover connected to the substrate for moving the substrate with respect to the chamber, heaters in the chamber for heating the substrate, and silica particle providers in the chamber for providing silica particles which deposit on the hot substrate, thereby fusing particles on the substrate, wherein the heaters heat the fused particles and other silica particles from the providers collect and stick on the particles and create preforms on the substrates.

2. The apparatus of claim 1, wherein the at least one substrate comprises a long hollow porous tubular substrates, and wherein the first and second movers rotate the long hollow porous tubular substrates within the chamber.

3. The apparatus of claim 2, wherein the heaters further comprise heaters within the hollow tubular substrate for heating the substrate.

4. The apparatus of claim 1, further comprising valved vacuum, dopant gas and purge gas ports connected to the chamber.

5. The apparatus of claim 1, wherein the at least one substrate is a hollow porous tubes, further comprising valved purged gas and dopant gas connections to the hollow porous tubes.

6. The apparatus of claim 1, wherein the silica particle providers comprise burners mounted in walls of the chamber for pyrolysis of silicon compositions for generating silica powder.

7. The apparatus of claim 1, wherein the silica particle providers comprise silica powder injectors in walls of the chamber.

8. The apparatus of claim 1, further comprising rotation and translation mechanisms connected to the at least one substrate for rotating and translating the at least one substrate in the chamber.

9. The apparatus of claim 1, further comprising independent rotation and support mechanisms connected to rods which are connected to the rotation and translation mechanism, and further comprising plural substrates connected to the independent rotation and support mechanism for rotating the plural substrates with respect to each other as the independent rotation and support mechanism rotates and translates the substrates within the chamber.

10. The apparatus of claim 1, further comprising heat controls connected to the heaters for increasing temperature within the chamber to vitrification temperatures for vitrifying and densifying the at least one preform in the chamber.

11. The apparatus of claim 1, wherein the chamber, the at least one substrate and the preform are vertically oriented, and wherein the particle providers provide particles from sides of the chambers.

12. The apparatus of claim 11, further comprising preform melting chamber below the preform forming chambers, and a movable shelf supporting preform forming chamber and the preform melting chamber, heaters adjacent the walls of the preform melting chamber and valved ports connected to the preform melting chamber for providing gas delivery, gas vent, vacuum and dopants, and wherein the heaters provide multiple heating zones in the chambers, and further comprising a rotating and pulling assembly connected to the preform melting chamber for withdrawing a fused silica member from the preform chamber.

13. The apparatus of claim 12, further comprising a plasma surface removal unit positioned below the rotation and pulling mechanism for finishing a surface of the fused silica member.

14. A fused silica producing apparatus, comprising a chamber having silica particle providers connected thereto for providing silica particles within the chamber, heaters within the chamber for heating the particles and fusing particles, a crucible within the chamber for collecting the heated and fused particles, heaters connected to the crucible for heating an fusing the silica particles in the crucible, a valved dopant gas supplier connected to the crucible for supplying dopant gas to fused particles within the crucible, a melting zone connected to the crucible for delivering molten fused silica from the crucible, a shaped body positioned below the melting zone for controlling flow of the molten fused silica, and a purge gas connection connected to the forming member for introducing a purge gas in a middle of the molten flow.

15. The apparatus of claim 14, further comprising an electrical field generator having inner electrodes positioned beneath the forming body and outer electrodes positioned adjacent the flow for passing an electric field through the molten fused silica flow.

16. The apparatus of claim 14, further comprising a second crucible positioned below the melting zone of the first crucible for receiving molten fused silica, a valved dopant gas inlet connected to the second crucible for introducing dopant gas into molten fused silica in the second crucible.

17. A method of producing fused silica fiber optics preforms, comprising relatively rotating at least one substrate in a chamber, heating the chamber and the substrate, directing silica particles inward in the chamber toward the substrate, fusing silica particles on the substrate, and sticking particles to particles held on the substrate and forming a porous silica preform on the substrate, and relatively moving the substrate and preform in the chamber.

18. The method of claim 17, wherein the providing silica particles comprises generating silica particles with pyrolysis of silica particle precursors from wall-mounted burners.

19. The method of claim 18, further comprising providing silica particle streams toward the substrate and preform.

20. The method of claim 19, further comprising providing dopant gases to the chamber and through the substrate, and providing purge gas to the chamber and through the substrate, and venting and removing gases from the chamber.

21. The method of claim 18, wherein the moving comprises relatively rotating and translating at least one substrate and preform within the chamber.

22. The method of claim 21, further comprising relatively rotating plural substrates and preforms with respect to each other in the chamber.

23. The method of claim 18, further comprising stopping the providing of particles and increasing heat on the preform for densifying and vitrifying the preform.

24. The method of claim 23, further comprising depositing a second layer of fused silica on the densified and vitrified silica preform.

25. The method of claim 18, further comprising a doped or undoped silica core on the substrate and depositing a doped or undoped cladding layer on the silica core.

26. A hot substrate apparatus for fused silica deposition comprising an elongated structural substrate having elevated temperature resistance capable of withstanding temperatures associated with silica fusing and having a surface capable of receiving and holding heated and surface-softened silica particles, and a heater for heating the elongated structural substrate to a temperature near a surface softening temperature of silica particles for causing silica particles to stick to the elongated structural substrate.

27. The apparatus of claim 26, wherein the elongated structural substrate comprises a rod or plate.

28. The apparatus of claim 26, wherein the elongated structural substrate has a constant cross section.

29. The apparatus of claim 26, wherein the elongated structural substrate has a variable cross section.

30. The apparatus of claim 26, wherein the elongated structural substrate is made from synthetic fused silica, natural quartz, ceramic, graphite, silicon carbide or boron nitride.

31. The apparatus of claim 30, wherein the substrate is doped.

32. The apparatus of claim 26, wherein the substrate is made of metal or metal alloys.

33. The apparatus of claim 26, wherein the substrate is a long hollow structural substrate.

34. The apparatus of claim 33, wherein the heater is a long heater disposed in the long hollow structural substrate.

35. The apparatus of claim 26, wherein the substrate is a long hollow tubular substrate.

36. The apparatus of claim 35, wherein the heater is a long heater disposed in the long hollow tubular substrate.

37. The apparatus of claim 26, wherein the substrate is a long hollow porous tubular substrate.

38. The apparatus of claim 37, wherein the heater is disposed in the long hollow porous tubular substrate.

39. The apparatus of claim 38, wherein the heater is a long hollow porous tube made from the same material as the long hollow porous tubular substrate.

40. The apparatus of claim 38, wherein the heater is a long hollow porous tube made from distinct material.

/ 41. Apparatus fro growing a silica preform comprising a chamber, a substrate within the chamber, a support connected to the substrate for supporting the substrate within the chamber, a substrate heater for heating the substrate, directed silica particle providers for directing the silica particles toward the substrate.

42. The apparatus of claim 41, wherein the substrate comprises a long hollow porous tube.

43. The apparatus of claim 41, wherein the substrate is a hollow porous tube, and the substrate heater is a hollow porous tube made from same or different material.

44. The apparatus of claim 41, wherein the substrate is a hollow porous tube made from a material selected from the group of materials consisting of silica, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys and combinations thereof.

45. The apparatus of claim 41, where the substrate is a hollow tube made from silica, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys, other suitable substrate materials and combinations thereof.

46. The apparatus of claim 41, where the substrate is a hollow porous or non-porous tube of doped or undoped synthetic fused silica or natural quartz.

47. The apparatus of claim 41, where the substrate is a hollow porous or non-porous rod of doped or undoped synthetic fused silica or natural quartz.

48. The apparatus of claim 41, where the substrate heater is a hollow porous or non-porous tube made from a material selected from the group of materials consisting of doped or undoped synthetic fused silica or natural quartz, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys and combinations thereof.

49. The apparatus of claim 41, wherein the substrate comprises a hot substrate for fused silica deposition that is a hollow porous or non-porous tube, rod, plate, that has any other shape and has constant or variable cross section over its length, width and height, made from a material selected from the group of materials consisting of doped or undoped synthetic fused silica, natural quartz, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys and combinations thereof.

50. The apparatus of claim 49, wherein the substrate comprises long hollow porous tubes.

51. The apparatus of claim 49, where the substrate is a hollow porous tube and the substrate heater is a hollow porous tube made from same or different material.

52. The apparatus of claim 49, where the substrate is a hollow porous tube made from silica, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys, other suitable substrate materials and their combinations thereof.

53. The apparatus of claim 49, where the substrate heater is a hollow tube made from silica, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys, other suitable substrate materials and their combinations thereof.

54. The apparatus of claim 49, where the substrate is a hollow porous or non-porous tube of doped or undoped synthetic fused silica or natural quartz.

55. The apparatus of claim 49, where the substrate is a porous or non-porous rod of doped or undoped synthetic fused silica or natural quartz.

56. The apparatus of claim 49, where the substrate heater is a hollow porous or non-porous tube, rod, plate, any other shape, and has constant or variable cross sections over its length, width and height, made from a material selected from the group of materials consisting of doped or undoped synthetic fused silica or natural quartz, ceramic, graphite, silicon carbide, boron nitride, metal, metal alloys, other suitable substrate materials and their combinations thereof.

57. The apparatus of claim 41, wherein the silica particle providers comprise silica powder and plasma mix injectors near walls of the chamber.

58. The apparatus of claim 41, wherein the silica particle providers comprise silica powder and gas mix injectors near walls of the chamber.

59. The apparatus of claim 58, wherein the silica particle providers comprise silica powder and gas mix injectors near walls of the chamber and at least one gas is a reactive gas for impurity removal.

60. The apparatus of claim 58, wherein the silica particle providers comprise silica powder and gas mix injectors near walls of the chamber and wherein at least one gas is a halogen containing gas for impurity removal.

61. The apparatus of claim 41, wherein the silica particle providers comprise plasma heated silica powder plasma mix injectors near walls of the chamber.

62. The apparatus of claim 41, wherein the silica particle providers comprise plasma heated silica powder plasma mix injectors near walls of the chamber and at least one part of the plasma is halogen gas plasma.

63. The apparatus of claim 41, wherein the chamber pressure is vacuum.

64. The apparatus of claim 41, further comprising a dopant gas source connected to the chamber for doping particles and an exhaust line connected to the chamber.

65. A method for making a fiber optic preform comprising supporting a substrate in a chamber turning the substrate, heating the substrate to a deposition temperature and collecting particles on the substrate.

66. The method of claim 65, wherein the collecting particles comprises forming a porous body on the substrate and collecting particles on the porous body.

67. The method of claim 66, wherein the forming the porous body comprises forming the body of from 0% to about 90% or more solid glass density.

68. The method of claim 65, wherein the directing the particles comprises streaming preformed particles.

69. The method of claim 68, further comprising heating the particles.

70. The method of claim 69, wherein the heating comprises creating a plasma and streaming the particles through a plasma.

71. The method of claim 70, wherein the streaming the particles comprises streaming the particles in a plasma.

72. The method of claim 71, wherein the streaming the particles comprises streaming the particles in a plasma with a neutral gas.

73. The method of claim 65, wherein the directing the particles further comprises reacting particle precursors at high temperatures in the chamber.

74. The method of claim 65, further comprising doping the preform by mixing dopant particles with the collected particles.

75. The method of claim 74, further comprising mixing dopant particles with the collected particles.

76. The method of claim 74, further comprising supplying dopant gas in the chamber.

77. The method of claim 76, further comprising introducing dopant gas to the preform through a porous substrate.

78. The method of claim 65, wherein the heating comprises heating the substrate form less than about 700 °C to about 1500 °C or more.

79. The method of claim 65, wherein the heating comprises heating the substrate from less than about 1200 °C to about 1400 °C.

80. The method of claim 65, further comprising controlling solid glass density of the preform by controlling temperature of the substrate.

81. The method of claim 65, wherein the heating comprises heating the substrate and preform from within the substrate and heating the substrate and the preform with external heaters in the chamber.

82. The method of claim 65, wherein the heating comprise controlling the heating of the substrate and controlling the heating from the external heater and controlling pore size and pore density of the preform for controlling radial gradient of doping in the preform.

83. The method of claim 82, further comprising removing the preform from the substrate and radially compressing the preform into a preform having a solid center.

84. The method of claim 82, further comprising increasing the heating and vitrifying the preform.

85. The method of claim 83, comprising removing the preform from the substrate and radially collapsing the preform into a preform having a solid center, further comprising reducing the heating and depositing additional particles on the preform.

86. The method of claim 84, comprising stopping the depositing, increasing the heating and vitrifying an outer layer of the preform.

87. The method of claim 86, further comprising removing the preform from the substrate and radially collapsingthe preform into a preform having a solid center.

88. The method of claim 85, further comprising changing the doping of the preform for radially producing lower index of refraction in outer portions of the preform.

89. The method of claim 82, further comprising introducing dopant through the porous substrate while depositing particles on the substrate, stopping the particle streams, reducing pressure in the chamber, increasing the heating of the substrate and preform to a vitrification temperature, vitrifying the deposited material in a first layer of the preform, reducing temperatures of the preform to a deposition temperature depositing particles on the preform, doping the deposited particles, stopping the depositing, increasing temperature on the substrate and preform to a second layer of the vitrification temperature and vitrifying a second layer of the preform.

90. The method of claim 89, further comprising reducing pressure in the chamber before vitrifying the first and second layers.

91. The method of claim 89, further comprising removing the preform from the substrate as a tube and collapsing the tube into a solid rod wherein the first layer is a solid core having a first level of doping and the second layer has a different amount of doping.

92. The method of claim 91, wherein the first layer solid core has doping for a higher index of refraction and the second layer has doping for a lower index of refraction.

93. The method of claim 92, wherein the second layer has a radial gradient of doping and a radial gradient of index of refraction.

94. The method of claim 92, wherein the first layer solid core has a radial gradient of doping and a radial gradient of index of refraction.

95. A method of making a glass rod, comprising heating a substrate, turning substrate in a chamber depositing particles on the heated substrate and on particles deposited thereon, and forming a preform removing the preform from the substrate as a tubular preform collapsing the preform and forming a glass rod.

96. The method of claim 95, further comprising vitrifying the preform before removing the preform from the substrate.

97. The method of claim 95, further comprising doping the preform.

98. The method of claim 97, further comprising stopping the deposition changing the doping of the preform.

99. The method of claim 98, further comprising stopping the deposition before the changing of doping.

100. The method of claim 99, further comprising continuing the depositing after changing the doping.

101. The method of claim 100, further comprising vitrifying the preform before changing the doping.

102. The method of claim 101, further comprising vitrifying an outer layer of the preform after the continued depositing.

103. A product made by the process of claim 102.

104. A method of making a fiber optic rod for forming fiber optic cores comprising supporting a substrate in a chamber, turning the substrate with respect to the chamber, heating the substrate, providing particles, depositing the particles on the heated substrate, and forming a preform removing the vitrified preform as a tubing from the substrate, collapsing the tubing and forming a solid rod from the tubing.

105. The method of claim 104, further comprising removing water from the particles.

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106. The method of claim 104, further comprising using the rod as a substrate for additional depositing.

107. The method of claim 104, further comprising mixing dopant with the particles and depositing the dopant with the particles.

108. The method of claim 104, wherein the substrate is porous and further comprising providing dopant gas through the substrate to the preform before vitrifying the preform.

109. The method of claim 105, wherein the substrate is porous and further comprising providing gas from the chamber through the preform to the porous preform.

110. The method of claim 108, wherein the substrate is porous and further comprising providing drying gas through the substrate to the preform before vitrifying the preform.

111. The method of claim 109, wherein the substrate is porous and further comprising providing drying gas through the substrate to the preform before vitrifying the preform.

112. The method of claim 104, further comprising providing varied levels of dopant while depositing the particles for creating radial doping gradients that result in a graded index of refraction in a radial direction.

113. The method of claim 104, further comprising providing a dopant in the chamber and varying deposition temperatures during the deposition for controlling and changing densities of the deposited particles for creating radial doping gradients that result in a graded index of refraction in a radial direction.

114. The method of claim 113, wherein the providing dopant further comprises providing fluid dopant in the chamber.

115. The method of claim 113, further comprising providing repetitive sequences of the depositing and doping followed by vitrifying for creating a vitrified preform having multiple vitrified layers with distinct dopant levels.

116. The method of claim 113, further comprising sequences of depositing and varying the dopant before vitrifying the entire preform.

117. The method of creating a rod for fiber optic applications comprising providing a substrate providing a porous preform on the substrate, heating the substrate, drying the preform, vitrifying the preform, removing the perform from the substrate, collapsing the preform into a rod and forming a core for a fiber optic application.

118. The method of claim 117, further comprising scintering the preform on the substrate.

119. The method of claim 117, further comprising doping the preform with fluid dopant after the drying.

120. The method of claim 117, wherein the preform is made by hot substrate deposition.

121. The method of claim 117, wherein the preform is made by a sol-gel process.

122. A product made by the process of claim 117.

123. The method of creating a tube for fiber optic applications comprising providing a substrate, providing a porous preform on the substrate, heating the substrate, drying the preform, vitrifying the preform, removing the preform from the substrate and forming the preform into a cladding for a fiber optic application.

124. The method of claim 123, further comprising scintering the preform on the substrate.

125. The method of claim 123, wherein the providing a preform comprises providing a doped preform.

126. The method of claim 123, further comprising doping the preform with fluid dopant after the drying.

127. The method of claim 123, wherein the preform is made by hot substrate deposition.

128. The method of claim 123, wherein the preform is made by a sol-gel process.

129. A product made by the method of claim 128.

130. A product made by the method of claim 123.

131. A method for making a fiber optic preform comprising providing a substrate providing a porous preform on the substrate, heating the substrate, drying the preform, vitrifying the preform, removing the preform from the substrate, collapsing the preform into a rod forming a core for a fiber optic application, creating a tubular perform for fiber optic applications further comprising providing a second substrate providing a second porous preform on the second substrate, heating the second substrate, drying the second preform, vitrifying the second preform, removing the preform from the second substrate, forming the second preform as a cladding for a fiber optic application, inserting the rod in the cladding and collapsing the cladding around the rod.

132. The method of claim 131, further comprising scintering the preforms on the substrate.

133. The method of claim 131, further comprising doping the preforms with fluid dopant after the drying.

134. The method of claim 131, wherein the preforms are made by hot substrate deposition.

135. The method of claim 131, wherein the preforms are made by a sol-gel process

136. A product made by the method of claim 131.

137. The method claim 131 wherein the core is doped and the cladding is undoped.

138. The method claim 131 wherein the core is doped and the cladding is doped.

139. The method claim 131 wherein the core is doped and the cladding is gradiently doped.

140. The method of claim 131 wherein the core is undoped and cladding is doped.

141. The method of claim 131 wherein the core is undoped and cladding is gradiently doped.

142. The method of claim 131 wherein the core and the cladding are gradiently doped.

143. The method of making a tubular fiber optic preform comprising providing a chamber, providing a support in the chamber, providing a substrate on the support, turning the substrate in the chamber, heating the substrate, directing fiber optic forming particles to the substrate, forming with the particles a tubular fiber optic preform on the substrate, and removing the tubular fiber optic preform from the substrate.

144. The method of claim 143 further comprising controlling porority of the fiber optic preform by controlling temperatures of the preform.

145. The method of claim 143 further comprising annealing and vitrifying the perform before the removing.

146. The method of claim 143 further comprising doping the preform during the forming.

147. The method of claim 146 wherein the doping comprises providing a radial gradient of doping in the perform.

148. The method of claim 146 wherein the doping comprises directing dopant particles toward the preform.

149. The method of claim 146 wherein the doping comprises providing fluid dopant in the chamber.

150. The method of claim 143 further comprising collapsing the tubular fiber optic preform to a sòlid cylinder after the removing.